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NEW METHOD OF PROTECTING BUILDINGS FROM LIGHTNING.

SPARE THE ROD AND SPOIL THE HOUSE!

Lightning Destroys. Shall it be Your House or a Pound of Copper?

PROTECTION FROM LIGHTNING.

What is the Problem?

IN seeking a means of protection from lightning-discharges, we have in view two objects,—the one the prevention of damage to buildings, and the other the prevention of injury to life. In order to destroy a building in whole or in part, it is necessary that work should be done; that is, as physicists express it, energy is required. Just before the lightning-discharge takes place, the energy capable of doing the damage which we seek to prevent exists in the column of air extending from the cloud to the earth in some form that makes it capable of appearing as what we call electricity. We will therefore call it electrical energy. What this electrical energy is, it is not necessary for us to consider in this place; but that it exists there can be no doubt, as it manifests itself in the destruction of buildings. The problem that we have to deal with, therefore, is the conversion of this energy into some other form, and the accomplishment of this in such a way as shall result in the least injury to property and life.

Why Have the Old Rods Failed?

When lightning-rods were first proposed, the science of energetics was entirely undeveloped; that is to say, in the middle of the last century scientific men had not come to recognize the fact that the different forms of energy—heat, electricity, mechanical power, etc.—were convertible one into the other, and that each could produce just so much of each of the other forms, and no more. The doctrine of the conservation and correlation of energy was first clearly worked out in the early part of this century. There were, however, some facts known in regard to electricity a hundred and forty years ago; and among these were the attracting power of points for an electric spark, and the conducting power of metals. Lightning-rods were therefore introduced with the idea that the electricity existing in the lightning-discharge could be conveyed around the building which it was proposed to protect, and that the building would thus be saved.

The question as to dissipation of the energy involved was entirely ignored, naturally; and from that time to this, in spite of the best endeavors of those interested, lightning-rods constructed in accordance with Franklin's principle have not furnished satisfactory protection. The reason for this is apparent when it is considered that the electrical energy existing in the atmosphere before the discharge, or, more exactly, in the column of dielectric from the cloud to the earth, above referred to, reaches its maximum value on the surface of the conductors that chance to be within the column of dielectric; so that the greatest display of energy will be on the surface of the very lightning-rods that were meant to protect, and damage results, as so often proves to be the case.

It will be understood, of course, that this display of energy on the surface of the old lightning-rods is aided by their being more or less insulated from the earth, but in any event the very existence of such a mass of metal as an old lightning-rod can only tend to produce a disastrous dissipation of electrical energy upon its surface,—"to draw the lightning," as it is so commonly put.

Is there a Better Means of Protection?

Having cleared our minds, therefore, of any idea of conducting electricity, and keeping clearly in view the fact that in providing protection against lightning we must furnish some means by which the electrical energy may be harmlessly dissipated, the question arises, "Can an improved form be given to the rod so that it shall aid in this dissipation?"

As the electrical energy involved manifests itself on the surface of conductors, the improved rod should be metallic; but, instead of making a large rod suppose that we make it comparatively small in size, so that the total amount of metal running from the top of the house to some point a little below the foundations shall not exceed one pound. Suppose, again, that we introduce numerous insulating joints in this rod. We shall then have a rod that experience shows will be readily destroyed—will be readily dissipated—when a discharge takes place; and it will be evident, that, so far as the electrical energy is consumed in doing this, there will be the less to do other damage.

The only point that remains to be proved as to the utility of such a rod is to show that the dissipation of such a conductor does not tend to injure other bodies in its immediate vicinity. On this point I can only say that I have found no case where such a conductor (for instance, a bell wire) has been dissipated, even if resting against a plastered wall, where there has been any material damage done to surrounding objects.

Of course, it is readily understood that such an explosion cannot take place in a confined space without the rupture of the walls (the wire cannot be boarded over); but in every case that I have found recorded this dissipation takes place just as gunpowder burns when spread on a board. The objects against which the conductor rests may be stained, but they are not shattered.

I would therefore make clear this distinction between the action of electrical energy when dissipated on the surface of a large conductor and when dissipated on the surface of a comparatively small or easily dissipated conductor. When dissipated on the surface of a large conductor,—a conductor so strong as to resist the explosive effect,—damage results to objects around. When dissipated on the surface of a small conductor, the conductor goes, but the other objects around are saved.

A Typical Case of the Action of a Small Conductor.

Franklin, in a letter to Collinson read before the London Royal Society, Dec. 18, 1755, describing the partial destruction by lightning of a church-tower at Newbury, Mass., wrote, "Near the bell was fixed an iron hammer to strike the hours; and from the tail of the hammer a wire went down through a small gimlet-hole in the floor that the bell stood upon, and through a second floor in like manner; then horizontally under and near the plastered ceiling of that second floor, till it came near a plastered wall; then down by the side of that wall to a clock, which stood about twenty feet below the bell. The wire was not bigger than a common knitting needle. The spire was split all to pieces by the lightning, and the parts flung in all directions over the square in which the church stood, so that nothing remained above the bell. The lightning passed between the hammer and the clock in the above-mentioned wire, without hurting either of the floors, or having any effect upon them (except making the gimlet-holes, through which the wire passed, a little bigger), and without hurting the plastered wall, or any part of the building, so far as the aforesaid wire and the pendulum-wire of the clock extended; which latter wire was about the thickness of a goose-quill. From the end of the pendulum, down quite to the ground, the building was exceedingly rent and damaged. . . . No part of the aforementioned long, small wire, between the clock and the hammer, could be found, except about two inches that hung to the tail of the hammer, and about as much that was fastened to the clock; the rest being exploded, and its particles dissipated in smoke and air, as gunpowder is by common fire, and had only left a black smutty track on the plastering, three or four inches broad, darkest in the middle, and fainter towards the edges, all along the ceiling, under which it passed, and down the wall."

One hundred feet of the Hodges Patent Lightning Dispeller (made under patents of N. D. C. Hodges, Editor of *Science*) will be mailed, postpaid, to any address, on receipt of five dollars ($5).

Correspondence solicited. Agents wanted.

AMERICAN LIGHTNING PROTECTION CO.,
874 Broadway, New York City.

SCIENCE

NEW YORK, OCTOBER 6, 1893.

CURRENT NOTES ON CHEMISTRY.—III.

[*Edited by Charles Platt, Ph. D., F. C. S.*]

British Association, Nottingham Meeting.

The International Scientific Congresses recently held in Chicago have attracted world-wide attention and have rightly been accepted as *the* feature of our great "Fair." But other meetings have also been held this summer, several of rather more than usual interest. At the meeting of the Iron and Steel Institute many valuable papers were presented, and more recently the meeting of the British Association for the Advancement of Science was opened at Nottingham, September 13. For some years past and for no well-founded reason, the meetings of the British Association have been but lightly attended by the pure scientists, but this present year, largely through the labors of Prof. Emerson Reynolds, M. D., Sc. D., F. R. S., President of the Chemical Section, Section B., a larger attendance was secured and a superior programme obtained. An attractive feature was the lecture by M. Moissan, on the preparation and properties of the element fluorine, together with exhibitions and demonstrations of his progress in chemistry and high temperatures.

Professor Reynolds's opening address before Sec. B. is an epitomized review of the work done during the past year, with special attention to certain features of advance made in our knowledge of chemical theory. Reference is made to the methods of inquiry and study in medicine, and while vast progress is shown during the past twenty-five years, the present state of the chemical branch of this instruction is deplored as leading to a knowledge of substances rather than of principles, of products, instead of the broad characters of the chemical changes in which they are formed. Without this higher class of instruction it is unreasonable to expect an intelligent perception of complex physiological and pathological processes which are chemical in character, or much real appreciation of modern pharmacological research.

A side light is being thrown on the nature of the elements by the chemico-physical discussion between Armstrong and Hartly as to the connection existing in the constitution of certain organic compounds and the colors they exhibit. We may take it as an established fact that a relation exists; and, if so, then why may not elements of distinct and characteristic color be considered as complexes analogous to definitely decomposable substances? The two elements, nickel and cobalt, of decided color in their salts and in their metallic plates, add strength to this idea in that they may be considered as exhibiting a sort of isomerism. Their atomic weights are the same within limits of experimental error; and, by analogy with compounds, identity of atomic weight implies dissimilarity in constitution and therefore definite structure.

The genesis of chemical elements is now being studied with the application of the principles of gravitation. Mendeleef, in 1889, first proposed to apply Newton's Third Law, and now Rev. Dr. Houghton in recently published papers applies the three Newtonian laws to explain the interactions of chemical molecules, with this difference only, that atoms have a specific coefficient of attraction varying with the nature of the atom concerned, whereas the specific coefficient of gravity is the same for all bodies independent of their composition or matter.

The remainder of Dr. Emerson's paper is devoted to a sketch of comparative chemistry, of great interest but rather difficult of condensation. Silicon is considered as an analogue of carbon. Nitrogen compounds of silicon are prepared and described, but it is shown that the combination is not a natural one and that, as silicon dissolves freely in molten aluminum, so in nature it is with aluminum that it most readily combines. Aluminum may then be considered, in this respect at least, as analogous to nitrogen. The natural alumino-silicates are, according to this standpoint, products of the final oxidation of sometime active silico-aluminum, analogues of carbo-nitrogen compounds rather than ordinary double salts. The alumino-silicates of the primary rocks are thus oxidized representatives of substances which foreshadowed in terms of silicon, aluminum and oxygen, the compounds of carbon, nitrogen and hydrogen required at a later date of the earth's history for living organisms.

Production of Pure Oxygen From Air and Furnace Gases.

A number of processes for the manufacture of pure oxygen from air have appeared recently, all following in a general way the suggestions of the well-known "Brin" process. Herr G. Kassner in the *Chemiker Zeitung*, claims a superiority for a salt of calcium, the calcium plumbate, Ca_2PbO_4, his process being briefly as follows: The plumbate in spongy porous pieces is exposed to the action of moist furnace gases which have previously been well washed. Carbonic acid is absorbed by the calcium salt with decomposition, forming calcium carbonate and free peroxide of lead. This decomposition is unaccompanied by a change of form. The resulting mass is transferred to a strong retort heated to redness. Oxygen is disengaged and the evolution facilitated by a stream of superheated steam. Finally carbonic acid is given off and in the last stages this is pure. In the intermediate stage the gases are passed over calcium plumbate and the carbonic acid there absorbed leaving the oxygen pure. Another similar process has been patented by Peitz, calling for the use of pure carbonic acid.

Le Chatelier proposes a direct method of heating to drive off the oxygen and a reabsorption of the oxygen from the air, but Kassner, who has already experimented with the direct method, considers the higher temperature, the larger expenditure for fuel necessary, and the consequent greater wear upon the retorts, serious obstacles successfully overcome only by his later indirect method.

Mr. L. Chapman, London, has patented a process depending upon the alternate oxidation and reduction of a mixture of manganese dioxide ("or a similar substance") with caustic soda by means of air and steam respectively. Finely divided manganese dioxide and caustic soda in the proportions necessary to the formation of the manganate are mixed with a weight of sodium sulphate equal to the weight of caustic soda taken. Air is passed through small pipes leading nearly to the bottom of the vessel,

thus assuring mixture and oxidation by the uprising current. When the oxidation is complete the air is shut off and the air in the upper parts and in the supply and exit pipes removed by means of steam. Dry steam is then passed. Nitrogen is obtained with a slight modification, by collecting the gas which escapes during the oxidation and again passing it through the mixture.

ELECTRO DEPOSITION OF IRIDIUM.

AT the Madison meeting of the American Association, Dr. Wm. L Dudley described his method for maintaining a constant metallic strength and purity in an electrolytic bath for the deposition of iridium. The electrolytic solution of the metal from an anode was of course desirable, but was found to be a tedious and expensive process. Success was finally attained by the use of (1) an oxide, or (2) a hydroxide, these to be insoluble in the electrolyte but freely soluble in the acid radicle set free at the anode. Iridium hydrate, $Ir(OH)_4$, was employed suspended in loose-fitting linen bags between the carbon anodes. Sodium iridichloride and ammonium iridichloride gave satisfaction as did also a solution of the hydrate in sulphuric acid with the addition of ammonium sulphate.

Dr. Wm. H. Wahl had evolved the same process for the platinum group after much independent study parallel with that of Dr. Dudley.

COMMERCIAL ORGANIC COMPOUNDS BY ELECTROLYSIS.

THE production of commercial organic compounds by electrolysis is a significant step in the advancement of electrolytic methods. F. Bayer & Co., of Elberfeld, are now producing the periodides of the phenols and the phenolcarboxylic acids by subjecting mixtures of solutions of the alkaline salts of phenols and of alkaline iodides to the action of the electrical current. A solution of the alkaline iodide is prepared and in this are immersed the electrodes separated by a diaphragm. The current is passed and at the same time an alkaline solution of phenol is gradually added. Two amperes per square decimetre of electrode surface is sufficient. In a few hours the phenol becomes entirely converted to the periodide, which separates out in solid form.

The electrolysis of a solution of ferrous sulphate to which a weak solution of proto-chloride of iron, sodium, potassium, calcium, vanadium or magnesium has been added produces a basic sulphate of the peroxide. Adding the equivalent of sulphuric acid before or after electrolysis forms the tri-sulphate of the peroxide of iron which is used in the preparation of dried blood manure.

MM. Hermite and Dubosc cause ferrous sulphate to circulate in an electrolytic apparatus, arranged to maintain a maximum amount of the salt in solution, and so obtain a saturated solution of the sulphate of the peroxide. By varying the current in density and duration more or less of this salt may be formed, constituting the various mordants known as "rust," "sulpho-nitrate" and "persulphate of iron." The apparatus consists of an enameled iron tank with an outlet for draining at the bottom, a perforated pipe in the lower part for supplying the solution, and an overflow at the top. The electrodes are plates of iron and thin sheets of platinum.

DETERMINATION OF IRON AND SILICON IN COMMERCIAL ALUMINUM.

DR. A. ROESSEL gives the following process for the determination of iron and silicon in commercial aluminum. Three to four grammes of the metal are gradually introduced into 35 cc. of hot potash lye (30–40 per cent). The metal dissolves leaving a black floculent residue. The solution is now supersaturated with pure hydrochloric acid in a platinum crucible without previous filtration, and is then evaporated to dryness. The mass is moistened with hydrochloric and the silica is determined in the ordinary way. For the determination of the iron, Roessel dissolves 3–5 grammes of aluminum as before and mixes with an excess of dilute sulphuric acid. The solution is heated until clear and is then titrated with potassium permanganate. The potash-lye used must, of course, be tested for silica.

NOTES AND NEWS.

THE AMERICAN BOOK COMPANY have issued several books for the study of classics, some of them new, and some merely new editions. Of the latter class are "Arnold's First and Second Latin Book" in one volume and "Arnold's Latin Prose Composition." These works, which have been in use for many years, have been revised by James E. Mulholland; the revision being confined to the correction of errors and a few minor additions, without changing the essential character of the original works. The two other classical books that lie before us belong to the series of which President Harper, of the University of Chicago, is one of the editors. In editing "The Aeneid (six books) and Bucolics of Vergil" Mr. Harper has been assisted by Frank J. Miller, instructor in Latin in the same university; and the edition they have prepared differs in some respects from most of those now in use. An important feature of the work is the series of "Inductive Studies," mostly grammatical, which precede the poem itself, and in connection with the notes and the vocabulary, are designed to give the student his grammar, notes and lexicon all in one volume. The book also contains twelve full-page illustrations, being reproductions of noted works of art. The other volume in the same series is an edition of the whole of "Xenophon's Anabasis," prepared by President Harper and James Wallace of Macalister College. This also contains inductive exercises and other grammatical helps, together with notes and a vocabulary. There is also an introduction showing the historical setting of the Anabasis, with a description of the Greek and the Persian modes of warfare and many pictorial illustrations of warlike material and other appurtenances of ancient life. These books are well printed and substantially bound.

—The Minnesota Academy of Natural Sciences, in conjunction with the St. Paul Academy of Sciences, made an excursion on Sept. 16 to Taylor's Falls, on the St. Croix River. The party numbered eighty persons. The sandstones overlying the Cambrian igneous rocks through which the St. Croix River passes, forming a beautiful erosion gorge and the bowlder conglomerate formed of the broken down igneous rock were inspected. The early age of the conglomerate is demonstrated by the presence in it and in the cementing sand of fossils of certain date. Pot-holes of great size are seen there, one into which access is possible holds more than twenty persons at one time.

—Messrs. Macmillan & Co. announce a second edition of Professor Goldwin Smith's brilliant sketch of the United States, the first edition of which was exhausted in two weeks. Written by an Englishman who regards the American commonwealth as "the greatest achievement of his race," this book must possess a peculiar interest for American readers.

—M. L. Holbrook, New York, will publish early in the Autumn another book by Bertha Meyer, author of "From the Cradle to the School," entitled, "The Child, Physically and Mentally; Advice of a Mother according to the Teaching and Experience of Hygienic Science; a Guide for Mothers and Educators." It has been translated by Friederike Salomon, revised by A. R. Aldrich.

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Attention is called to the "Wants" column. It is invaluable to those who use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

COLLECTION OF MEXICAN MAGUEY PAINTINGS.

ALEXANDER VON HUMBOLDT—America's scientific discoverer, as he was called after his return to Europe from this continent—when sojourning in the City of Mexico (1803) took care to acquire a certain amount of ancient hieroglyphic paintings, which, among other relics of Aztec civilization, had once been collected by the Cavalier Boturini Benaducci, yet were confiscated by the government of New Spain, and later on handed over for study to Leon de Gama, a professor of astronomy in whom the learned traveller had found a coadjutor for his manifold scientific pursuits.

In 1806, Humboldt made this precious purchase a present to the Berlin Royal Library, in the shelves of which the large portfolio had been resting, "not disregarded, but unopened," until the year 1888, when it was brought to light for the inspection of the Members of the Congress of Americanists assembled in the same year in the city of Berlin. The collection consists of sixteen sheets of maguey paintings in more or less fragmentary condition, the photographic facsimiles of which were published a few months ago at the cost of the Royal Library, to be its special commemorative gift to the Columbus Centennial Celebration. Only three copies of it have reached the United States. The sheets are about one foot ten inches wide, and two feet six inches long, with the exception of No. I., which shows the considerable length of fifteen feet by one foot ten inches.

The task of interpreting the paintings devolved on Dr. Eduard Seler, Curator of the American Department in the Ethnological Museum of Berlin. The text he wrote forms a book of 137 pages, octavo, with a carefully arranged index. The headings of the sheets are inscribed as follows: No. I.: A list of tribute extending over nineteen years and paid by trimester to a certain temple. II.: A list of the lots of the Royal Domain *Camaca* and of their former usufructuaries. III. and IV.: Fragments of historico-geographical contents, originating from *Huamautla* (Tlaxcalla). V.: Fragment of a household ledger, village *Tecontepec*. VI.: A court proceeding in the city of *Tezcuco*. VII.: Account of certain victuals furnished by the mayordomo of *Mizquiyaualan*. VIII.: Fragment of a cataster-roll, with name of proprietor, area and quality of soil. IX–XII.: Fragments of court-trials (complaints). XIII.: Account given by the mayordomo of *Mizquiyauallan* of work done weekly by women of the pueblo. XIV.: Account of wood, forage and victuals furnished. XV.: An account of turkeys furnished. XVI.: The Articles of Faith and the Ten Commandments, both in hieroglyphics.

Here, then, at last, some fresh material for study has made its appearance, which the students of Mexicology were a long time yearning for, in view of the scanty and somewhat superannuated stock of Mexican Calendar Codices. If nothing else, the diversity of contents alone must have gladdened the heart of the enthusiastic interpreter, and have paid him richly for the labor bestowed on the work. "I have learned something," he exclaims somewhere. One portion of the sheets (Nos. I., III., IV.), turned out to contain records written in the epoch before the Spanish Conquest; other records reach as far as the year 1571. This fact is of some importance. For in the former the names of persons and places still appear in their primitive ideographic simplicity, whereas in the others the influence of modern syllabic spelling makes itself noticeable—a subject often ventilated with regard to the absolute reliability of certain Codices. On the other hand, some of the sheets afford a graphic insight into the economic comfort of the *curas* and *encomenderos*, by exhibiting the quantity and good quality of all those things that were to be supplied by the parishioners and tributaries for the sustenance of the ample households of their taskmasters. Sheet No. II. is of specific historical interest. It shows us *Moctezuma* II., the Severe, arrayed in file with his successors, generals and other dignitaries, inasmuch as they were authorized by the Spanish Crown to remain keepers and heirs to certain portions of land, up to the demise of the last blood-relative of the unfortunate dynasty. In No. VI. we recognize a painting already published and described by Humboldt himself in his great work: "Vues des Cordillères et Monuments des Peuples indigènes de l'Amérique." He took it for representing "un procès entre des naturels et des Espagnols," the object of litigation being a farm. We learn from Dr. Seler that the object of the process was not a farm, but a claim about the extent and boundaries of the Royal city of *Tezcoco*, whose prominent edifices and hieroglyphic name are delineated on the plan, together with her last King *Tecuilotzin* and certain known members of the Royal Audiencia. The last sheet, No. XVI., is a veritable curiosity. It is one of those pictorial illustrations of the Roman Catholic Catechism, which the missionaries used to hang on the walls of the parochial schools for the purpose of helping the natives to learn by heart the principal tenets of the Christian religion. These wall pictures are mentioned by Bemesel and Las Casas. This Humboldt specimen, however, is the first that has cropped out from scores of them that must have existed.

We cannot help expressing our highest admiration for the skill with which the learned interpreter has solved the riddles laid before him. The sense of each of these sixteen problems is as ingeniously grasped by him in its whole, as it is methodically proved and explained in all its details. In this Dr. Seler has shown that he has mastered the true methods of inductive argumentation. But he is also possessed of the great gift, so to speak, of pictorial intuition and vision. Without the aid of this felicitous talent there is not much chance for the interpreter of ideographic writing either to seize the correct meaning of each individual symbol and hieroglyph, or, when he has done so, also to combine the various elements into that text which the native hierophant would have written had he been acquainted with the resources afforded by our alphabet. V.

—Dr. William Patten has been appointed Professor of Biology at Dartmouth College, Hanover, N. H. The department is a new one and will be well equipped.

RING PHEASANT.

BY A. G. PRILL, M. D.

Phasianus torquatus, (Grml). Common name: Chinese or Mongolian Pheasant.

Habitat: Western United States, Willamette Valley and southward into California.

Description—Male, total length 34 to 40 inches. Length of tail, 15 inches to 24 inches. Bill dark, 1⅜ inches long. Iris yellow. Crown, greyish green, with a white stripe extending over each eye. Around the eyes is found a large red patch of hair feathers.

Neck: Changeable green and purple, following which is a circular band of pure white, extending around the neck, and from this it receives its name.

The breast and points of the shoulders are a changeable, fire red and purplish blue, the border of the feathers being tipped with blue. Following in the median line is a narrow strip of blue feathers, which gradually emerge into black, as we approach the under tail coverts, which are greyish brown.

The tail consists of 16 feathers, the outer ones being shortest and gradually becoming longer, up to 15 or 24 inches, the two centre feathers being longest. The under coloring is greyish black; the upper, brown, with light gray and black, and brown bars.

Upper tail coverts, Irish green, bordered with old gold and tinged with bright green.

Under wing, grayish white. Body light yellow, and end of feathers tipped with blue.

The female has none of the bright markings of the male, and is about two-thirds the size of the male, of a uniform mottled pale yellow, with slight shades of brown, black and gray variously intermixed.

The above description, although deficient in many respects, will, I hope, convey some idea of the beauty of this species. The description is taken from an adult male and female in my collection.

This bird was imported from China by O. N. Denny some eight years ago. Six pair were let loose on Petterson Butte, about four miles from this place (Sodaville, Ore.), and the climatical conditions and country being favorable and being protected by a strict law for six years, they have multiplied rapidly, and now are one of our most common game birds. In fact they multiplied so rapidly that long before the six years' protection had ceased, the farmers complained bitterly that the birds were a serious damage to their grain and gardens, and many birds were killed, but in this I think they were mistaken, for in my examination of many stomachs, at all seasons of the year, I found but very little grain as their food, but many wild seeds, bugs, grasshoppers, etc.

I think that the farmers have realized this, also, to some extent, as nearly all have now posted trespass notices for their protection.

The birds are not as abundant as two years ago, as many were slaughtered by pot hunters for the Portland and San Francisco markets.

The bird is an easy wing shot, but has many devices to deceive the sportsman. I have known them to lie so close that in passing within four feet I did not discover the bird, and the bird will not fly until seen by you, and then it is off like a flash, making a great noise and cackling. They are very swift of foot; it requires a good dog to catch one that has been winged.

The breeding habits are somewhat peculiar. The female deposits her first complement of eggs about April 10 to 15. As soon as the young leave the nest they are taken in charge by the male, and the hen proceeds to lay a second complement of eggs, which in each case is generally ten to fifteen eggs. As soon as hatched the male also takes these in charge, and the female deposits a third sitting, which is generally about eight eggs. When these are out of the shell, one can see the entire band of three broods and male and female together. Two broods are always raised, and in many cases three. Only a few days ago I saw a brood not over ten days old. They nest upon the ground, which is generally a mere hollow, lined with leaves, under some small bush or in a clump of grass and in an open field.

Oat stubble field is a favorite resort, also fern ridges.

In captivity the birds do well and even breed, but are never domesticated, for as soon as let out they at once fly away and do not return.

The bird seems to be fearless, coming into the barnyard and feeding with the fowls.

During the spring the males crow similar to our fowls. This is during the mating season. Their love antics are queer and grotesque.

The males strut around the females, with wings drooped and tail expanded and elevated, all the while uttering a low gutteral sound. This performance is kept up for hours at a time.

During snow storms and frosty weather, many birds are caught here, as in roosting over night the long tails of the males freeze fast in the snow, and they are unable to get up, and one can walk up and pick them up.

I hope that the bird will, in time, be introduced into other parts of the United States and flourish, and thus give to our country one of the most beautiful game birds known.

THE BENDIGO GOLDFIELD.

BY T. S. HALL, M. A., CASTLEMAINE, AUSTRALIA.

The first portion of a report by Mr. E. J. Dunn, on the Bendigo Goldfield, has just been issued by the Victorian Department of Mines and is full of interesting matter, put both clearly and concisely. The rocks of the field were long ago referred by Prof. Sir F. M'Coy to the same horizon as the Lower Landeilo rocks of Britain. The auriferous quartz reefs show a very peculiar structure. In most cases they occur as lenticular masses, arching over the anticlinal axes. North and south, in the direction of strike, they extend in some cases for miles, while in the direction of the dip they thin out rapidly, rarely extending for 300 feet. Mining operations show a series of the "saddle-reefs," as they are termed, one below the other. In the Lazarus mine, for instance, in sinking 2,200 feet, no less than twenty-four of these "reefs" were encountered. It is evident, that during the process of rock-folding, which has produced an average dip of 65°, cavities were produced between the beds into which the quartz segregated. It is, of course, a well-known fact that the axis of an anticline is rarely a horizontal line, but undulates more or less vertically in the direction of its bearing, but till Mr. Dunn's report, based on careful survey, appeared, the full bearing of this fact on our auriferous rocks was overlooked. This "pitch" of the anticline in Bendigo rarely exceeds 30°, but a case is quoted where it was as high as 60°. As the "saddle-reefs" lie between the bedding planes the "pitch" had, of course, been recognized by the miners, who appropriated for it, most unfortunately, the geological term "dip." As a consequence of this pitch, the deepest rocks are brought to the surface in the central portion of the area, and are the most highly auriferous. Surrounding this area is a larger one, in which the reefs do not yield gold so freely. Surrounding this second area is a third area, consisting of the highest rocks of the district and in which gold has not been found in payable quantities. The extent of the central area is about ten square miles.

No attempt has as yet been made to work out the graptolite zones in these rocks, but it seems probable, considering the enormous thickness of the rocks, that such zones will be found. The most plentiful graptolite of the central area is *Tetragraptus fruticosus*. Besides this form there are two other species of *Dedymograptus*, *Tetragraptus quadribrachiatus*, *T. bryonoides*, *Dichograptus octobrachiatus*, *Loganograptus Logani*, *Goniograptus Thureaui*, *Phyllograptus typus*, *Thamnograptus typus*, and some forms apparently referable to *Dendrograptus*. All these species, it will be remembered, occur in the Quebec group of rocks. A crustacean of common occurrence is *Lingulocaris M'Coyi* (R. Etheridge jun.). This is the same as the oft-quoted *Hymenocaris Salteri*, a manuscript name of Professor M'Coy's. Two species of *Protospongia* occur, but are rare.

The extension of the Bendigo rocks to the southward along the line of strike is cut off by a newer granite, which is about ten miles across. To the south of this again comes the Castlemaine goldfield. The river gravels of this area, both recent and tertiary, were very rich in gold, but although a few rich "reefs" were found they did not prove of a permanent character, and mining is now at a very low ebb in the district. The structure of the country is similar to that of Bendigo. The anticlines succeed one another very rapidly, being only about three hundred yards apart, as a rule, and the strike is very constant. The main axis of elevation passes through the township of Chewton, about two miles east of Castlemaine, and the lowest beds contain a graptolitic fauna, apparently identical with that of Bendigo. Two or three other zones may be recognized overlying this one. *Tetragraptus fruticosus* does not range above the lowest zone. *Didymograptus bifidus* is the commonest fossil in the next zone, and the problematical *Didymograptus caduceus* of Salter marks the next. The other recognized species agree very closely with those of the Quebec group, species of *Tetragraptus*, *Dubograptus*, *Logarograptus*, *Goneograptus*, *Temnograptus*, *Thyllograptus*, *Dendrograptus* and *Thamnograptus* occur.

THE MARINE TERTIARIES OF AUSTRALIA.

BY T. S. HALL, MA., CASTLEMAINE, AUSTRALIA.

Tertiary beds of marine origin are extensively developed in the southern portion of Australia, forming a more or less broken fringe along the coastline from the head of the Great Australian Bight to the Snowy River in the east of Victoria. With the exception of a prolongation up the basin of the Murray River they do not extend far from the coastline and attain no great height above the sea. They are absent from the eastern coast of Australia, being apparently faulted below sea-level. Till of late years very little has been done towards the elucidation of the fauna, only a few species having been described. Recently, however, Professor Ralph Tate, of Adelaide, has done a great amount of work among the Mollusca and Echinoderms of the series and has enabled several workers to enter the field. The fauna is remarkably rich, especially in the older rocks, and not far short of 2,000 species have been recorded. The limit is far from reached, as fresh forms are coming to light at every new locality visited. Several papers descriptive of the beds as seen in different localites, with more or less imperfect lists of fossils, have appeared in the publications of the Royal Societies of South Australia and of Victoria. The most exhaustive one is by Mr. J. Dennant, on the beds of Muddy Creek, Victoria.*

More recently Professor Tate and Mr. Dennant have, in the same publication, begun the work of correlating the whole series of beds as shown in the two colonies.

*Trans. Roy. Soc. S. Australia.

By Professor Sir F. M'Coy the lowest and most widely occurring beds are referred to Oligocene age, and he refers others, which differ lithologically, to the Miocene. Messrs. Tate and Dennant class both as Eocene, and it has been shown that in one locality at any rate the so-called Miocene really underlies the so-called Oligocene. The lists from Muddy Creek, above alluded to, show 511 recorded species, of which only one and a half per cent are living at the present day.

The fauna of the older tertiaries presents a more tropical aspect than that found on our coasts at the present day. Murex, Vobeta and Cypræa are extensively developed and often of gigantic size; the *Cypræa gigas* of M'Coy, for instance, is a very globose form and reaches the length of eight inches.

The strata consist of sands, clays and limestones, the latter being usually composed in the main of polyzoal remains. In some places an Orbitoides limestone occurs, the chief species being *O. Mantelli*. The clays yield the greatest numbers of forms, which in some places are beautifully preserved in a stiff blue clay that cuts like new cheese.

The Miocene beds of Tate and Dennant are not so extensively developed as the Eocene, while Pliocene beds with marine fossils are still rarer. In many places marine gravels occur, which have been ascribed to this age, but apparently on very slight grounds. Where they will be placed now is quite uncertain.

Below the lowest marine beds, and frequently separated from them by a denuded basalt-flow, is, in some places, a series of terrestrial and fresh-water deposits with plant remains with beds of lignite. These have, for many years past, been spoken of as Miocene. It is now proposed to remove them to the Cretaceous. It will be a strange thing if we have to wage war in a case so closely comparable with the Laramie one.

THE SCIENTIFIC MAN ON THE FARM.

BY CHARLES B. COOK, OWASSO, MICH.

For many years the average farmer has been a man of few resources. His city brother has outwitted him in every department of his business. He has availed himself of no opportunity to secure a scientific education, and still worse, his county paper is the only periodical that ever enters his dwelling. As a result he is ignorant of the most vital laws that underlie farm husbandry in all of its branches and "farms it" in a general "go-as-you-please" style. These facts alone are sufficient to account for the farmer's general reputation as a man totally unfit for any other business. To make a bad matter worse, the illiterate farmer is continually belittling his profession to an extent that is limited only by his vocabulary.

In direct contrast to the above style of farmer the scientific agriculturalist is growing more and more to take hold of the farm, not only as a field for experiment and study, but as a vocation that will generously respond, financially, in direct proportion to the amount of mental force applied; for it is a fact just beginning to dawn on the minds of the public that the farmer's bank account compares most favorably with that of his professional brother, and where genuine ability prevails, coupled with a love for the vocation wherein one is called, the farmer's account is likely to run ahead.

The educated farmer of to-day is placed almost beyond competition, while the lawyer, the mechanic and the doctor find talented competition on every corner. The scientific man's education enables him to make the most

of the occult laws of nature governing farm life. By a knowledge of economic botany he is able to make the most of his soil and crops by a judicious selection of plants best adapted to his farm, both as regards soil and climate.

Insect enemies are becoming more numerous as the country grows older. New insect pests are continually arising, and those that for long years have been branded as *"thieves and robbers"* in the Old World are being continually introduced. While these insect pests are a constant thorn in the flesh to the illiterate farmer, the scientist is able to ward off their attack, and thus be greatly benefited, personally, by their general depredations. The same is also true of germ diseases, such as pear blight, peach yellows and the like, as such diseases make large crops and correspondingly large prices possible only in the hands of the skilled horticulturalist.

A knowledge of physiology is also of great use to the man who would make the most of the farm. Plant physiology and veterinary science are branches of farm economy the importance of which is just beginning to be realized.

And last but not least the educated farmer is a man able to devote much time to the literature of the day. In the farm journals he finds the latest and best ideas of the most progressive men which aid him in thinking and planning for himself, and in turn contributing his mite to the agricultural press.

There is an old saying that education drives men from the farm, but we are just coming to recognize the fact that the average college graduate with a scientific education, finds on the farm an opportunity for original investigation and financial success fully equal or exceeding that in any other vocation. This assertion finds abundant proof in the lives of many practically scientific farmers, and also in the fact that numerous college men are going onto farms every year, who become enthusiastic and devoted agriculturalists that hold their farms in the highest esteem.

We are rapidly approaching the time when a "survival of the fittest" basis must characterize the life of the American farmer. In times past our vast areas of tillable land have formed a basis for almost exhaustless agricultural operations. This state of affairs, coupled with the fact that a man failing in all other vocations can make a living on a farm—provided he possesses only the power of mimicry born of ignorance—is sufficient to explain the low intellectual standard on the farm, and also accounts for the manner in which the cheap farmer is universally held in derision.

Severe competition on the farm is already being felt and the poorest managers are continually going to the wall. We forget that it is the man that hampers the agricultural profession and not the farm that grinds its occupant.

The educated agriculturalist is slowly but surely driving the uneducated and unthinking man from the field. With the retirement of every quack and the corresponding advent of the thinking man on the farm arena, is elevated the whole agricultural profession, which is thus brought one step nearer its true position that it justly held in Roman times—the foremost rank of all the world.

The uneducated man goes onto the farm as a last resort. His other resources have either failed or never materialized, and he is compelled to eke out an existence in what he considers a belittling business. On the contrary, the educated man goes onto his farm out of love for his chosen vocation, respect for his farm and faith in his ability to make the farm an unqualified success. He makes his home a model of comfort and convenience that may well excite the envy and admiration of his most well-to-do city brother. For besides the comforts and luxuries within his reach he enjoys absolute peace and seclusion unknown to city life.

Let us have more men with active brains and more culture and refinement in rural life, and we will hear less of unproductive and abandoned farms and less of farmers' boys going to the city for a more congenial business.

THE ECCENTRICITIES OF A PAIR OF ROBINS.

BY OLIVE THORNE MILLER, BROOKLYN, N. Y.

One never looks for eccentricities in the robin family, and great was my surprise at the curious conduct of a pair who came under my observation last Summer. I fear their heads were turned by a disappointment to begin with, for they successfully raised a brood of three in a nest under the edge of the veranda roof, and never displayed any vagaries. When the young birds had flown, the deserted nest was removed, because the veranda was to be painted.

On beginning to think of a second brood, they seemed greatly disturbed at the loss of their nest. They had fixed their hearts on that veranda, and for days they could not give it up, and judging from subsequent events I am inclined to think it seriously unsettled them. They inspected every corner, the top of the columns where the nest had been, the support that held a string of corn for the squirrels, a peg driven in under the roof, the niche over the door, the chinks in the lattice,—none of them were satisfactory, and at last they turned their attention elsewhere.

They did not seem to please themselves, although several times we thought they were settled, and one day it became plain that trouble was brewing between them. Like some bigger folk, they had let their mutual calamity sour them toward each other.

Madam had plainly selected for the new homestead a delicate crotch on a frail branch, close beside the veranda where her heart was. This was the first sign of aberration of mind, for it was an absurd choice, ludicrously inadequate to the demands of a robin's nest, and her sensible little spouse refused to consent, but kept himself out of sight and hearing of such folly.

But she had made her decision; she began to build. The first I saw of her, she came with a beakful of dried grass from the lawn, flew up to the selected branch near the tree, and then ran out on it as on a path, till she reached the crotch. I was delighted. I had long wished to watch the whole process of building a nest, and here I saw my chance. It was in plain sight, and the robins had learned not to fear us. I placed myself, and the show began.

The bird came with her mouthful of grass, as I said, and when she arrived at the spot, she simply opened her beak and let her load fall. Some of it lodged in the crotch, but most of it fell to the ground. Down she went at once and gathered it up, returned by her pretty path,—and repeated the performance!

Then a kind bird-lover from the house scattered some short pieces of string on the walk for her use. She saw them at once, came down, gathered up an enormous beakful, returned to her branch, and dropped them as she had the grass. Hardly a particle lodged, and she went down and brought it up again; even a third time she repeated the operation.

By this time it was plain to lookers-on that her heart was not in her work, that she was merely "pretending" to build, that, in fact, she was in a "tiff," undoubtedly with her mate. But she went through all the motions so charming to see when done in earnest. She settled herself in the crotch as though it were a nest. She tried it this side and that, and she made great pretence of having

definitely settled the matter. Meanwhile her mate, who had still a good deal of care of three dapper young robins in the evergreens (their first family), had apparently selected a heavier crotch in a better place, and he busied himself about that spot, not making any attempt to build, but merely showing his preference.

Madam would not look at him. Finally while she was absent, he came down to a vase on the lawn, a favorite perch of his, where he had sung away many a twilight hour, and began a very low, sweet song. It was alluring; hard indeed must be the heart that could resist it.

She did come, but she did not join him on the vase. She had another load of material, and flew at once to her chosen tree. He stopped singing and looked at her. She alighted and ran out on the branch as she had done before, and, as before, the material she had collected fell to the ground. Then she flirted herself over the crotch in a petulant way that tumbled off every scrap that had lodged there. Plainly she was "mad" and did not seriously intend to build there at all.

After this display she flew away, and her observer on the vase went to the ground where he could look through the passage she had taken. Presently the captious little dame returned with an empty beak, and alighted near him on the lawn. To our amazement he instantly ran away several feet, then paused. She advanced toward him, and he ran farther, keeping always a few feet from her. It actually appeared as if he were on the defensive.

This sort of performance went on for some time. Occasionally both were out of sight behind the low-growing evergreens, then both would return and go on as before, he never letting her get nearer to him than five or six feet. It was painful to see this bad state of things in our heretofore amiable couple, and we sorely regretted having torn down the nest.

It is one of the maddening things to the bird-student that he cannot keep his game always in sight. No matter how great the crisis in their lives, nor how absorbing his interest, a flit of the wings carries them out of sight in a moment. Then again they are such distressingly early risers. If the student tear himself away from his pillow before the sun shows his face, he will find bird-life in full blast. Before it is light enough to see well, their day of work and play is begun. We shall never thoroughly know the feathered folk till we rise at their uncanny hour and learn to fly!

Before we got the robin fairly in view again—probably in those tantalizing morning hours—their difficulties had straightened out, and building was going on seriously in a maple tree a little down the road, quite near the other, but out of sight from the veranda.

Two or three weeks passed in peace, and we hoped the robin troubles were over. Every day we saw the hard-working sire, followed around by his three young folk, as big as he was, calling and teasing for food.

Then one evening the robin treated us to a strange performance. He stood on the ground in the middle of the carriage way, crouched, so that he almost rested on the gravel, his head sunk between his shoulders, and looking as if he were at his last gasp. But he was uttering low notes, and we listened. It was a constant repetition of the queer unmusical sort of "que-e-e" with which many robins end their song. This is neither a trill nor a distinct note, but a sound as if the bird had tried to reach a high note and the voice had broken.

The bird repeated it again and again, and with varied inflections and movement. Plainly he was practising it. What could be his object? and why that unnatural attitude? Had he been crazed by his troubles, and was he a candidate for the lunatic asylum? or was he perchance a genius, evolving a new song for the robin tribe? Evidently he was bound to evolve something, for he practised without ceasing.

After awhile he moved a little so that his tail—still resting on the ground—was deflected to one side, in a very unnatural position, and there he stood motionless for half an hour or more, still constantly making the strange noises. All this time we had not been positive of his identity, but now he turned his head up as though addressing some divinity in the tree with his grotesque strains. He was not ten feet from us, and it was eight o'clock and perfectly light, so that we saw him distinctly. Just as we were concluding that some accident must have befallen him and we ought to go down to see, he suddenly straightened himself up on his legs, shook himself out, and sang out loud and clear his regular song. That made it certain that it was our friend of the maple tree, and we were fearful that his mate being at last settled and in her right mind, he had himself broken down. Our host, however, refused to take this desponding view. He insisted that the bird felt within him the stirrings of genius, and that he was founding a race of robins with a new song.

Certain it is that he kept up the strange practisings evening after evening, though never again on the ground. Madam, his spouse, sometimes came down and looked at him, as if to make up her mind whether he was simply unfortunate and to be pitied, or whether he were vicious in deliberately violating all robin traditions, and she ought to discipline him. Apparently she was unable to decide, for she returned to her undoubted duty, and he kept up his droll entertainment till the next instalment of his family came on to demand all his time and strength, and robin music ceased altogether.

At the end of July I left the scene of this robin eccentricity, but my comrade, who remained, heard so late as the middle of October, the same sort of performance going on among thick berry-bushes, at some distance from the house, and on starting up the bird she found it to be a robin.

Could it be the same bird? And shall we have a new sort of robin music next spring?

BIOLOGICAL NOTES FROM NEW ZEALAND.—II.

BY GEO. M. THOMSON, DUNEDIN, N. Z.

In a previous paper (*Science*, Vol. XX., p. 323), attention was draw to the fact that the plants of New Zealand are nearly destitute of all such structures as are correlated with the presence of mammalia. *A priori* this is what might have been expected in a country in which there were no indigenous mammals. Those plants which have defensive structures, such as spines, prickles, etc., and those whose seeds or fruits are fitted for adhering to the coats of passing animals belong in almost every case to species having a wide range outside of New Zealand, the inference being that the characters referred to have been developed outside the New Zealand region, and that such species have been introduced into these islands at a comparatively recent period.

Another interesting feature in the flora is the relation existing between the flowering plants and the various agencies which are necessary for fertilizing the blossoms. Visitors to these islands are usually struck with the prevailing dark hue of the evergreen vegetation and the apparent absence of flowers. Associated with this is a corresponding absence of conspicuous insects,—especially large Lepidoptera and Hymenoptera,—which are such active agents in this work in most other parts of the world. While it is true that there are a few species of flowering plants of exceptional beauty, such as *Clianthus puniceus* and the splendid white Clematis (*C. indivisa*,) yet the general verdict is correct that the flowers of the

lowlands are chiefly inconspicuous. There is a beautiful flora on the mountains above the bush-line, i, e., from 3-5,000 feet, but with the exception of a very few striking species like *Ranunculus Lyallii*,—the so-called Mt. Cook Lily,—most of the flowers are only conspicuous by their aggregation; and nearly all such are white, with, in a few cases, a tinge of blue or lilac. The individual flowers of *Pygmæa*, *Helophyllum*, *Donatia*, etc., are small, but when one comes on hummocks of from one to three feet in diameter, with the flowering branches so densely crowded that the blossoms are in contact with one another, then such species may well be considered to be conspicuous. Some of the most singular of such aggregated flowers occur in the composite genus *Raoulia*. The individual plants are small, and are only a few inches in height, while their branches grow in dense masses, each ending in a small head of florets surrounded by pure white bracts, giving them a daisy-like appearance. When in flower on the mountain side, such masses are, when viewed at a distance, readily taken for sheep, and shepherds, unless provided with a good field-glass, may be, and often are, easily deceived; hence the popular name of Vegetable Sheep has been given to some of the species, especially to *R. mammillaris*.

Though conspicuous insects are rare, and the two orders already referred to are somewhat poorly represented, yet the number of flowering plants which depend on insects for fertilization is very considerable. Fully one-fourth of the total number are entomophilous, to judge by the fact that they are more or less conspicuous, and (or) are fragrant, and (or) possess nectar-glands; and of the hermaphrodite species which may or may not be insect-fertilised, about 37 per cent exhibit decided protandry, their stamens maturing before the pistils. This fact is almost always associated with insect-fertilization, while protogynous plants on the other hand are nearly always anemophilous or wind-fertilized.

The chief agents in fertilizing our indigenous flowers are flies and flower-haunting beetles. It is somewhat unfortunate from a biologist's point of view that the natural conditions have been very much obscured during the last twenty or thirty years by the introduction and very rapid increase of insectivorous birds. Many of the large hairy flies which used to be most abundant formerly are now comparatively rare, while the clearing and burning of the surface growth over great part of the country has thinned out the beetles and other insects to an amazing extent, not only by actually burning the individuals themselves and their eggs and larvæ, but also by destroying their breeding ground.

A few of the largest of the native flowers are fertilized by birds; the agents in this work being the Tui or Parson Bird, the Korimako or Bell Bird (Honey bird), the Kaka or large bush parrot, and the two or three species of parroquets. Fuchsias, Ratas (*Metrosideros*), Flax (*Phormium*), etc., seem to be quite dependent on the birds. In recent times the imported bees, both hive and humble (*Bomb*) have taken to visiting several of the native flowers.

A feature of interest, regarding which I have no adequate explanation to offer, is the occurrence of a very large proportion of unisexual flowers in the flora. About forty five per cent of the known flowering plants are unisexual, and of these a great number are diœcious. Several of these diœcious species are inconspicuous, such as the large liliaceous *Astelias*, and the Mistletoe (*Tupeia antarctica*), yet their flowers are most distinctly entomophilous, being fragrant and nectariferous. It is a still more remarkable fact that in the outlying islands of the Lord Auckland and Campbell groups, which are distinctly oceanic, in the sense that they are isolated from all larger masses of land by a deep ocean, there are several remarkably fine flowering plants, such as the Composites *Pleurophyllum speciosum* and *criniferum*, and *Celmisia vernicosa; Gentiana cerina* and the liliaceous *Anthericum Rossii*. The last-named is diœcious, and the others are most probably protandrous (judging only by the analogy of allied forms), but all have very beautiful and conspicuous flowers, and all are confined to these islands. Again in the Chatham Islands occurs the very fine for-get-me-not,—miscalled the Chatham Island Lily,—(*Myosotidium nobile*). retaining its beautiful pale-blue colors, as if evidently to attract insects. This plant, however, is self-fertile, but this characteristic must be an acquired one of comparatively late date. The flying insects of all these islands have never been investigated, yet it must be borne in mind that all the islands are of small size and are subject to strong winds; indeed the antarctic groups are swept by south west gales during considerable portions of the year. The question naturally arises, How are the flowers fertilized,—especially when diœcious as in *Anthericum?*

These are a few of the interesting points which botanists in New Zealand have met with during the few years since the insular flora began to be closely studied. The questions which arise are perhaps not so remarkable as those which the zoölogist meets with, but they bear on the same ground, and must be studied as closely in order that true views of the past biological history of these islands and of the geographical distribution of its organisms may be arrived at.

THE AMERICAN FOLK-LORE SOCIETY.

The fifth annual meeting of the American Folk-Lore Society was held in Montreal on Sept. 13th and 14th.

In the absence of Mr. H. Hale, of Clinton, Ontario, the president, and of Prof. Alcée Fortier, of New Orleans, the first vice-president, the task of presiding devolved upon Prof. J. P. Penhallow, of McGill University, Montreal.

The forenoon of the first day was devoted to the meeting of council, the report of which showed steady growth in membership and fair results in study, collection and contributions to the literature of the subject. The *Journal of American Folk-Lore* is now approaching the conclusion of its sixth volume, has proved both a stimulus to inquiry and a thesaurus of gathered data, curious and valuable. It is hoped that the scheme for the publication of special memoirs will shortly yield the first fruits of what may one day become a rich harvest. The members number more than six hundred, and there are flourishing local branches at New Orleans, Boston, Montreal and New York.

In the afternoon Professor Penhallow, as president of the Montreal Branch, delivered an address of welcome to the visiting members of the society. After touching on what had already been achieved in the working of the great northern field, he indicated several paths of folklore research that could be prosecuted best among the populations of Canada and called attention to many points of interest in the district of which Montreal was the centre.

Mr. W. W. Newell, general secretary of the society and editor of the *Journal*, expressed the pleasure that it afforded him to be again in Montreal. Hardly eighteen months ago he had shared in the organization of the local branch, and was naturally pleased to see it prospering. Coming direct from Chicago and the wondrous White City, which was "all mankind's epitome," it was a relief to survey a scene of repose and order and cleanliness, while still acknowledging the fascinations of the Fair, with its unique opportunities for seeing the world's diversities of speech, belief, costume and usage.

Professor Penhallow, having asked Mr. K. Boissevain to

act as secretary, vacated the chair in favor of Prof. A. H. Chamberlain, of Clark University, Worcester, Mass.

Papers were then read on "Canadian Folk-Songs," by Mr. J. Reade of Montreal; on "Some Popular Oaths," by Mr. J. M. LeMoine, of Quebec, and by Prof. Heli Chatlain, of Loanda, Africa, on "Some Causes of the Retardation of Civilization in Africa." Mr. Chatlain's paper was the first-hand testimony of one who knew them intimately by years of residence and close association, to the superiority of the African race (the Bantu) physically and intellectually. He confessed that he had been educated to regard the negroes as the lowest in the scale of human creation, an unsuccessful attempt at man-making and a clog on the wheels of progress, and that the sooner it was made to give place to the European race the better it would be for the world. But his prejudice had gradually yielded to the logic of facts. He found natives of Africa, he said, not only on a par with Portuguese, German and English, when they were given the same advantages of education, but even in advance of them. He gave instances of such superiority in business, in the professions, in literature and science, from the German and Portuguese settlements in which he had resided. How then, their intellectual powers being thus unsurpassed, has it happened that the natives of Africa have been left so far behind not only by the white, but the yellow and, some say, even the red races? To this natural question M. Chatlain replies that, after nine years of personal experience and a much larger period of study, he had come to the conclusion that the causes for the stagnation of the African race were: (1) Seclusion; (2) The lack of a system of writing; (3) Polygamy and Matriarchy; (4) Slavery, and (5) The Fear of Witchcraft. Each of these points the essayist treated clearly from his own experience of the working of the system or defect which he condemned. Professor Chamberlain having thanked Mr. Chatlain for his valuable paper and invited discussion on it, some of the members questioned the correctness of Mr. Chatlain's estimate of the negro's intellect, and declined to accept a few examples of proficiency as the basis of so sweeping a theory. Prof. Chatlain replied to these criticisms, giving the reason for his belief, which was an actual acquaintance with the negroes of several of the Portuguese, German and British colonies.

In the evening a conversazione, which showed some novel features, was held in the Recital Hall, St. Catherine street, and was well attended. It consisted of illustrations of the music of Canadian folk-songs; of examples of Montreal street cries, repeated by phonograph, with lantern views of the criers exercising their callings. The musical part of the programme was in charge of Mr. H. C. St. Pierre, Q. C., and Mr. St. Pierre, and the cries, the success of which was largely due to Dr. W. G. Nichol, were in the care of Mr. Prowse. Ex-Mayor H. Beaugrand gave a lecture on pictographs, with lantern illustrations from La Hontan, etc. Altogether a pleasant and not uninstructive evening was spent.

On Thursday, the 14th, Professor Penhallow presiding, the reading of papers was continued. Mr. Newell treated of "The Study of Folk-Lore, Its Material and Objects." Having defined folk-lore, in its most comprehensive sense, which transcended the bounds set by the literal meaning of "folk" as virtually equivalent to the Latin "vulgus," with which it is allied, he went on to show the vast range of the science. Contemplating its mental and spiritual bearings, he suggested, as possibly acceptable generations hence, the term "palæo-noology" (analogous in formation to palæontology) to indicate the scientific history of mind through the long course of its development. Then, after surveying the field in the old world and the new he directed attention to the great mass of practically unknown folk-lore existing in Canada. Of this he urged the importance of a systematic quest.

Professor Chamberlain read (in part) a paper on "The Mythology of the Columbian Discovery," pointing out the far-reaching revival of Hellenized Celtic and other myths due to the disclosure of cis-Atlantic land four centuries ago. He referred to the Terrianoge (or land of perpetual youth), Valhalla, Avelion, St. Brendan's Voyage, Chicora, Cebola, Norumbega, Eldorado, as well as to the old Atlantic myth, the Garden of the Hesperides, the Insulæ Fortunatæ and other divagations of Greek and Roman mythology, and from passages in Shakespeare, his contemporaries and the writers that followed them down to a comparatively recent date, he showed how the renascence of these old-world stories influenced the minds of succeeding generations. He mentioned the Quetzalcoatl-St. Thomas hypothesis and other theories of white culture heroes visiting the western world; Madoc, the Amazons, the notion of Albino and negro Indians and other imaginary or monstrous beings.

Mr. Newell read an interesting paper by Mr. F. D. Berjeur on "Dextral and Sinistral Ceremonial Circuits," which treated of popular ideas as to the direction in which certain processes, culinary, industrial, medicinal and religious, should be conducted. A paper was also read on "Devil-Worshippers of India," by Dr. Thomas S. Bulmer, of Salt Lake City. Papers on the folk-lore of the Azorian Portuguese of New England, by Prof. W. R. Lang; a comparative study based on one of the Brer Rabbit cycle of folk-tales, by Professor Gerber; a paper on Irish folk-lore, by Mrs. E. Fowell Thompson, etc., were presented by the Secretary.

The Committee on Nominations made the following report:

President, Prof. Alcée Fortier, New Orleans; First Vice President, Capt. W. Matthews, U. S. A., Fort Wingate, N. M.; Second Vice President, Rev. J. Owen Dorsey, Bureau of Ethnology, Washington, D. C.; New Councillors, Professor Penhallow, Montreal; Prof. M. M. Curtis, Hudson, O.; Dr. A. H. Chamberlain, Worcester, Mass.; Curator, Stewart Culin, Philadelphia. The other officers are, W. W. Newell, Cambridge, Mass., Permanent Secretary; Prof. J. Walter Fewkes, Boston, Mass., Corresponding Secretary; Dr. John H. Houton, New York City, Treasurer. The committee proposed as honorary members the following: J. Lawrence Gomme, President of the English Folk-Lore Society; Prof. E. B. Tylor, LL.D., Superintendent Pitts-River's Museum, Oxford; H. Gaidoz, editor of *Melusine*, Paris; Paul Sebillot, Secretary of the Societe de Traditions Populaires, Paris; Dr. F. S. Krauss, Vienna; Jean Karlowitz, Warsaw; Dr. Kaarle Krohn, Helsingfors, Finland; Dr. Giuseppe Pitre, Palermo, Sicily; Prof. J. C. Coelho, University of Lisbon; John Batchelder, Hakodate, Japan; Horatio Hale, M. A., Clinton, Ont.; Major J. W. Powell, Director of the Geographical and Geological Survey and of the Bureau of Ethnology, Washington; Dr. D. G. Brinton, University of Pennsylvania, Philadelphia, Pa.

The foregoing nominations being submitted to the meeting, were approved. New Orleans was proposed as the next place of meeting, but no decision was arrived at.

R. V.

SOME REMARKS ON THE KINETIC THEORY OF GASES.*

BY S. TOLVER PRESTON, HAMBURG, GERMANY.

The theorem that the velocities of the molecules of a gas vary "between zero and infinity" (between zero and a

*Reprinted, by request of the author, from the Philosophical Magazine for May, 1891.

velocity indefinitely great) would seem to give the idea that the velocities are enormously great sometimes.

But it would appear that there are distinct physical conditions tending to limit the velocities of the molecules of a gas (*i. e.*, the velocities capable of being acquired in the accidents of collision). First, there is the friction of the molecules in their passage through the æther. This must be considerable at high velocities, since meteoric dust is measureably retarded from this cause; and the relative friction or resistance to passage increases as the size of the body diminishes. So that probably by the known small size of molecules, the friction must be very great. Second, the resistance to passage is augmented from the fact that the molecule is in vibration (or some analogous motion about its centre of gravity) in the æther. The molecule is like a rough body then, stirring up the æther during its translatory motion, which must greatly augment the resistance to passage. That there is friction in the æther by the passage of molecules is also confirmed, as it seems, by the fact that waves of heat and light contain energy. For how should a vibrating molecule impart energy to the æther without friction or resistance? The resistance is, in fact, a measure of the energy imparted. It appears a question whether, if the amplitude of the vibration (or motion which stirs up the æther) of molecules were known, the friction or resistance could not be calculated therefrom. For we know the number of vibrations accurately by the spectroscope, and the energy imparted to the æther (or contained in the waves), by the thermopile. To deduce the resistance to passage represented by the act of vibrating or swinging, we only appear to require the amplitude of vibration then. Perhaps a limiting value for this could be approximately arrived at.

Another cause tending to reduce the velocity of translatory motion possible to the molecules of gases in the accidents of collision, consists obviously in the fact that the internal motion of the molecule (vibration, rotation, &c.) is proportional to the translatory velocity. So if a molecule attained an excessive translatory velocity, it would acquire an excessive vibration. This vibration would soon dissipate the energy in the æther in the form of waves of heat; and at the next succeeding collisions, the molecule would acquire a relatively slower translatory motion, as it could not retain the necessary vibratory motion (internal motion) which is the essential accompaniment of a very high translatory velocity. So, therefore, from all these causes, the speeds capable of being acquired by the molecules of gases in the accidents of their encounters, are probably moderate; and far less, perhaps, than might be inferred from the theorem that the velocities vary between zero and a velocity indefinitely great.

Referring to a letter received from the late Prof. Clerk Maxwell, I find that—"The number of molecules whose velocity is more than five times the mean velocity is an exceedingly small fraction of the whole number, less than one millionth. But if there were 10^{100} molecules, many millions of these would have velocities greater than five times the mean, and yet this would produce no appreciable effect on the whole mass."

It seems, then, from the above that the number of molecules attaining high speeds is relatively rare. But it appears none the less worth noting distinctly that an indefinitely great velocity would mean a velocity indefinitely greater than the speed of light even. Suppose a few molecules to attain extreme stellar velocities of say 200 miles per second; it is evident that the friction in the æther (appreciable in the case of meteoric dust) would commence to tell in reducing the velocity. And as for a molecule supposed to acquire the speed of light itself, the molecule would (in traversing the æther) resemble much a cannon ball moving through the air at the normal speed of the air-molecules themselves—about 1600 feet per second—where the resistance to passage is very considerable, so it seems that there are in practice physical conditions limiting the velocities attainable by the molecules of gases; the resistance to passage augmenting more than in proportion to the velocity. It is not at all as if those molecules were moving in empty space. A molecule, if assumed to acquire an infinite velocity, would certainly have to be assumed to possess an infinite energy. It may be questioned whether even the total energy of translatory motion of the stars in the collective universe is infinite in sum; if not, then a single molecule with a supposed infinite velocity would require to have a greater total energy than this. The expression "infinite velocity" apparently only comes into the mathematical calculations applicable to a gas, supposed infinite in extent. But in these calculations it seems tacitly to be supposed that the molecules are moving in empty space, which is, however, not a fact. On the contrary†, the molecules move in a resisting substance whose obstruction to motion increases in a high ratio with the velocity of the bodies which traverse the resisting substance.

DISCOVERY OF ANOTHER ANCIENT ARGILLITE QUARRY IN THE DELAWARE VALLEY.

BY H. C. MERCER, DOYLESTOWN, PA.

On June 23, 1893, with the help of my assistant, Edward Frankenfield, I discovered another ancient argillite quarry, on the left bank of Neshaminy Creek, on the Warner farm, about three-quarters of a mile above the mouth of Mill or Labaska Creek (Bucks County, Pennsylvania).

No artificial hollows as at Gaddis Run have yet been found in the surrounding woods, but the rock here rising in a low cliff above the stream is argillite, and the water eating away the bank below it has revealed layers of chips, charcoal, large worked masses, pitted as if to split with the grain, pebble hammer stones and "turtle backs." A broken yellow jasper spear blade was found by Frankenfield 100 yards higher up the stream.

While the Gaddis Run quarry (noticed in *Science* of

†The late Prof. Clerk Maxwell arrived at some data as to the size, etc., of molecules. If we assume a hydrogen molecule to vibrate through an amplitude (say) two-thirds of its diameter at a certain temperature, we can obviously get the total distance traversed through the æther in one second by the molecule through its vibrations, i. e., the total distance equal to the sum of the amplitudes of all the vibrations of the molecule in one second. That is, add together all the amplitudes, and find what distance that would make in a straight line. The size of the molecule is taken from Maxwell. I find this distance to be about ninety miles, i. e., the molecule vibrates at the rate of ninety miles per second, by the above assumed amplitude of vibration in terms of dimensions of molecule (which seems quite possible). According to Maxwell, two million hydrogen molecules placed in a row would occupy a millimetre. Hence it appears practicable that molecules can vibrate at a greater rate than a planetary velocity, which may seem surprising to some, considering how small the dimensions of molecules are (and therefore their amplitudes of movement). The velocity of the earth in its orbit, for instance, is eighteen miles per second, as is known. The above comparatively high estimate for vibratory velocity of molecules (ninety miles per second, only a rough estimate, of course) may account rationally for the energy contained in the heat-waves of gases and other bodies, which (energy) is a measure of the friction or resistance opposed by the æther to the vibration or movement of a body in it. Calculations of this kind, although, of course, only approximate, may give us conceptions or ideas of the æther structure. If I had by me data as to the energy of the waves emitted by a gas (radiating power), it would obviously not be difficult to compute the static resistance opposed by the æther to the vibratory movement or swing of the molecule in it, in terms of the weight of the molecule, i. e., in terms of gravity. Whether we have here a swing of the molecule, a movement of rotation oscillatory in its nature, or any movement of a repeated kind, the same considerations evidently in principle apply. In the above computation, the wave length of a hydrogen molecule is taken to average one thirty-nine thousandth of an inch.

June 9, 1893,) is twenty-five miles by the river above Trenton, these much smaller and less noticeable workings lie only fourteen miles inland east northeast from the site of the celebrated gravel discoveries.

Neshaminy Creek flows into the Delaware (right bank) about three miles below Bristol, (Bucks Co., Pa.,) and a walk to the quarries by following up the winding stream from the river would cover a distance of about twenty miles.

BOOK-REVIEWS.

Iowa Geological Survey, Volume I: First Annual Report, for 1892. By SAMUEL CALVIN, State Geologist, Des Moines, 1893. 472 p., 8vo. 10 plates and 26 figures.

In addition to the administrative reports, the first report of the new survey contains seven papers, one of which is by the state geologist, three by the assistant state geologist C. R. Keyes, and the others by various members of the survey staff. The introductory paper, by Mr. Keyes, on the Geological Formations of Iowa is a summary of present knowledge of Iowa rocks. The author has here taken occasion to revise the classification of these formations to correspond with the progress made in their study in recent years with a very satisfactory result.

The Sioux quartzite is referred to as a doubtful element still in the geological section. The discovery of undoubted eruptive rock within these beds in southeastern Dakota by Culver and Hobbs, and in presumably the same beds in northwestern Iowa by the present survey, as set forth in fuller detail in Mr. S. W. Beyer's paper, is a matter of much interest and tends to add probability to the view entertained by Hayden that these rocks are much younger than commonly supposed.

The changes in nomenclature are much for the better, as for example, Oneata for Lower Magnesian; St. Croix for Potsdam; while in the Devonian the attempt to correlate the Iowa rocks with the New York section is abandoned. Prof. Calvin's work upon these formations has resulted in a four-fold division with names from places where the best sections are shown.

In the Lower Carboniferous, or Mississippian, the term Augusta is advocated for the terrane which Williams called the Osage, a name here shown to be inapplicable. We would differ with the author as to the advisability of dropping the term Warsaw as a sub-division of the Augusta in so far as concerns the rocks of Iowa, for though probably of limited development they present constant and easily recognized characters throughout the southeastern part of the state. An error occurs in the definition of the St. Louis limestone on page 72. The brecciated limestone is not the basal member, as asserted by the author, but in many sections along the Des Moines River there is shown to be from five to fifteen feet, or more, of a brown, quite regularly bedded magnesian limestome underneath the brecciated member and resting upon the arenaceous division of the Warsaw beds below.

In his discussion of the structure of the Coal Measures the author presents a valuable contribution to the literature of this subject, and advances conclusions acceptable alike for their simplicity and adherence to generally accepted principles of deposition.

The description of the Cretaceous formation is professedly taken from Professor Calvin's notes. Evidence is accumulating to show that these rocks have a much greater development in Iowa than heretofore considered. Three divisions are recognized and correlated with Hayden's Dakota, Fort Benton and Niobrara groups. The position of the Fort Dodge gypsum beds and the Nishuabotua sandstone are left undetermined.

In Mr. Beyer's paper there is given an account of the discovery in a deep well at Hull, Sioux County, Iowa, of quartz-porphyry—an eruptive rock, interstratified with sandstone. It occurred all the way from seven hundred and fifty-five feet down to twelve hundred and twenty feet, aggregating about one hundred and eighty-seven feet in thickness. To account for the presence of these rocks, the author advances two theories: (1) that they were due to secular outflow of lava upon the ocean bottom in Palæozoic times, (2) that they represent intrusive subterranean sheets from a Post-Carboniferous volcano. The latter view is considered the most probable. In the absence of evidence as to the age of the sandstones, however, we see no reason why a third view may not be entertained, viz., that they were secular overflows from a Post-Carboniferous volcano.

In Mr. H. F. Bain's paper we have an interesting and instructive discussion of the St. Louis limestone as found in Mahaska County, Iowa, while Mr. G. L. Housen's paper deals with the economic phases of some Niagara limestones.

An Annotated Catalogue of Minerals and a Bibliography of Iowa Geology by Mr. Keyes, complete the volume. The latter paper occupies more than half of the report and shows evidence of much care and painstaking labor, though a paper by the writer on the Keokuk limestone, published in the *American Journal of Science* for October, 1890, has evidently escaped the attention of the author.

The report has been printed from new and excellent type, the illustrations are exceptionally good, and altogether the volume in its make-up presents a pleasing contrast to many similar publications.

Typographical errors are not numerous, though some occur in prominent places, as, for examaple, in the word Survey on the title page, and in the words Tennessee and Territory on plate VI, though these can hardly be considered typographical. Errors appear also in the words Sandstone, p. 149, and Glacial, p. 139. A further criticism might be made on the lettering on the back of the volume, which scarcely seems in keeping with the pleasing effects of the text. But these are minor matters, and the survey and the state are to be congratulated upon the general excellence of their first report.

The Microscope: Its construction and management. Including Technique, Photo-micrography, and the Past and Future of the Microscope. By DR. HENRI VAN HEURCK, Professor of Botany and Director at the Antwerp Botanical Gardens; late President of the Belgian Microscopical Society; Hon. F. R. M. S. and New York M. S. English edition re-edited and augmented by the author from the fourth French edition, and translated by Wynne E. Baxter, F. R. M. S., F. G. S. With three plates and upwards of 250 illustrations. London, Crosby, Lockwood & Son, New York, D. Van Nostrand Co., 1893. 382 p., Roy. 8vo.

It is due mainly to Professor Abbe, of Jena, that, during the past twenty years, a real science of "microscopy" has come into existence, the aim of which is to develop the theory of the objective and to enlarge its hitherto limited powers. In fact the practical application which he has made of the laws of diffraction is the basis of by far the greater part of all the advance which has recently been made in the use of the microscope for scientific purposes. His investigations have not only resulted in the production of lenses of unequalled delicacy and perfection but have imparted a new interest to the study of purely theoretical optics and have given rise to a large and growing literature of the subject. The increased importance thus conferred on this phase of the matter, together with the rapid broadening of the field of research, has led to a desirable separation between the study of the microscope as an instrument, and the study of the results of its employment.

Dr. Van Heurck's book is in the line of this change of relation. Its purpose is a survey of microscopical science from its technical, or, perhaps we should say, manipulative side. Although the language into which the work is translated is seldom wholly easy and natural, and occasionally becomes even awkward and obscure, the author may feel that, on the whole, his subject is presented to English readers in an interesting and attractive form. Dr. Van Heurck has long been known as a patient student of certain difficult problems in interpretation and a diligent cultivator of lines of microscopical work calling for expert skill in the handling of accessories, and it is in these directions that his book is strongest and most complete. We should hardly be justified, however, in characterizing his work as a symmetrical and systematic résumé of even the mechanical side of what is commonly known as microscopy. In truth it seems to us to be somewhat lacking in order and in equality of treatment of its various topics. It is in a measure a record of the author's own contributions to the progress of his favorite department of learning and therefore of necessity bears an evident personal stamp. The pride which he feels in his long experience and creditable achievements doubtless affects to some extent his sense of proportion, so that points to which he has himself happened to give particular attention are at times accorded what we may regard as a little undue prominence. Thus, for example, we are inclined to think too much space is given, and too much importance attached, to the subject of electrical illumination (pp.109-117), and that the praise bestowed upon the stand devised by Dr. Van Heurck (pp.224-232) is rather more unqualified than is appropriate to the circumstances under which it appears. One may reasonably question his assertion that "electrical incandescent illumination is superior to any other kind of illumination" for the microscope, and may well doubt whether he is fully justified in pronouncing his own stand "a perfect instrument." But these criticisms need not be taken as any disparagement of Dr. Van Heurck's authority on questions of construction and manipulation. In these matters, as we have already said, his knowledge and ability are generally conceded, and the novice will not go far astray in following his advice. If there is any fault to be found with his guidance it is likely to be that in places it is too profuse and painstaking. Thus, in common with most other writers of microscopical text-books, he appears to us unnecessarily lavish in the space devoted to the mere cataloguing of the instruments of many makers, which differ from one another mainly in pattern; and we feel disposed to ask whether a general description of the essential parts and qualities of a good stand, in each class, would not answer every purpose and enable the author to dispense with some pretty bad borrowed woodcuts. While on this subject, we venture to suggest, also, that much of the details under the heading "The Photographic Processes" might be omitted with profit, since they rehearse particulars which one may obtain in any manual of photography and which are not peculiar to photo-micrography. Indeed, some of the directions seem to be merely extracts from a general hand-book, as, for instance, where we are told (p. 272) that in development we shall get "first *the sky* and the high lights."

Beyond those portions which deal with the handling of the instrument and the preparation of specimens, this work undertakes to cover the theory, the history and the literature of the microscope. The chapter devoted to "Experiments on the Application of Dr. Abbe's Theory of Microscopic Vision" is a reproduction of Mr. J. W. Stephenson's very valuable paper presented to the Royal Microscopical Society in 1877, which Dr. Van Heurck has edited with a view to making it conform to the modifications which Prof. Abbe's views have since undergone. The chapter on "The Microscope in the Past and in the Future" is an abridgment of the Cantor Lectures of Mr. John Mayall, Jun., delivered in 1885. The chapter headed "The Microscopist's Library" is an incomplete list of periodicals and books not always up to date.

Notwithstanding the fact that the work before us is rather too sumptuous and bulky for everyday use by the student, it will doubtless prove a welcome addition to the library of the scientific amateur, and will perform a useful part in the promotion of interest in the instrument of which it treats.

LETTERS TO THE EDITOR.

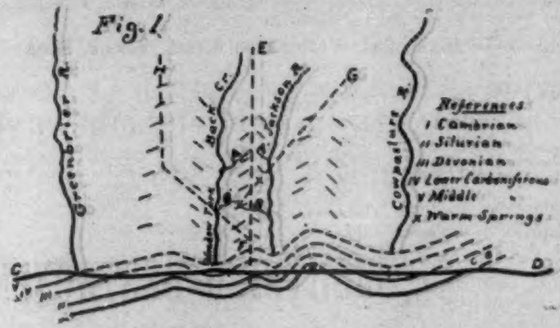
***Correspondents are requested to be as brief as possible. The writer's name is in all cases required as a proof of good faith.

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

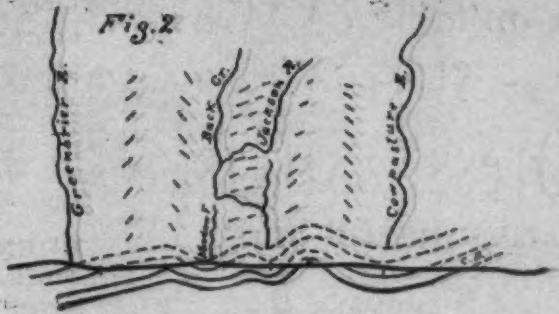
A Recapture From a River Pirate.

The Jackson River of Bath and Alleghany counties, Virginia, affords an interesting example of recapture of a



portion of a stream from "a river pirate." Last winter I directed the attention of Messrs. Charles Baskerville and R. H. Mitchell, students of the University of North Carolina, to the interesting problem of adjustment presented by this stream. A result of their investigation is given in the accompanying sketch maps.

Fig. 2 presents a map of the stream in its present relations, and a geological section of the country. In fig. 1 we have the streams at the beginning of their existence, just after the great permian deformation, occupying synclines upon the carboniferous rocks. The permian topography is represented by the dotted lines, the existing topography by the line C D. It is evident that in permian time Back Creek and Meadow Fork made a continuous stream, occupying a synclinal valley. The first capture was that of the headwaters of Jackson River by



tributary A of Back Creek, as the folds of permian time were higher to the east and died away westwardly. At a later date, probably at the time of the cretaceous tilting, when the hills sloping east became steeper, tributary B, of Jackson River, beheaded the pirate and recaptured her own waters. Collier Cobb.

Chapel Hill, N. C.

The Tin Ores of New South Wales and South Dakota.

The similarity of occurrence and of mineral aggregation of the tin ores of New South Wales and those of the Black Hills, South Dakota, is worthy of mention. The ores of both regions are extensively shown in the Mines and Mining Building, Chicago Exposition, and it would be difficult, if not impossible, for an ordinary observer to separate them according to locality if they should become mingled. The ores of both places occur in veins of the granitic type. Wm. P. Blake.

Shullsburg, Wis., Sept. 11, 1893.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

For Sale.—A collection of fossil Rhinoceros bones (Aphelops fossiger Cope.) from the Loup Fork Tertiary, including all the bones of one fore and one hind leg, the pelvis, representative vertebrae and ribs, and a nearly complete skull, with complete lower jaws. All the bones of the limbs are perfect. Price $250. Address Dept. of Paleontology, University of Kansas, Lawrence.

For Exchange.—Books and pamphlets on geology, ornithology, conchology, and entomology. State what line and I will send list. I want Odonota from any locality, and literature on this group. M. J. Elrod, Ill. Wes. Univ., Bloomington, Ill.

For a rare chance to get a first-class microscopical outfit write for full particulars to box 125, Sellersville, Bucks Co., Pa.

For sale or exchange.—A fine collection of Lepidoptera, native and exotic. For particulars address Addison Ellsworth, Binghamton, N. Y., care Republican.

For sale or exchange for works on entomostraca, Wolle's "Desmids of the U.S.," Hentz "Spiders of the U. S.," The Amer. Entomologist & Botanist, Vol. 2, The Amer. Entomologist, Vol. 1, Harris's "Insects Injurious to Vegetation," colored plates, copy formerly owned by Townend Glover. C. Dwight Marsh, Ripon, Wis.

"The Conchologist: a Journal of Malacology," Vols. 1 and 2, with wood cuts and plates, value 12]-will exchange for any works or pamphlets on American Slugs or Anatomy of American Fishes. W. E. Collinge, Mason College, Birmingham, England.

Wants.

WANTED.—A copy of Mascart & Joubert's Lessons in Electricity and Magnetism, Vol. I. Address R. W. Clawson, Vanderbilt University, Nashville, Tennessee.

CHEMIST.—Graduate of a polytechnical school, and studied photographic chemistry in Germany and Austria. Situation teaching or in analytical or experimental laboratory. M. B. Punnett, Rochester, N. Y.

WANTED.—A recent college graduate to assist in editorial work on Science. Those seeking large emoluments need not apply. N. D. C. Hodges, 874 Broadway, New York.

A GRADUATE in medicine, experienced, will prepare or revise scientific and medical manuscript for publication, read proof, compile bibliographies, &c. Will also consult New York libraries for persons out of town wishing references to rare works. Address M. D., 104 Cambridge Place, Brooklyn, N. Y.

FOR SALE.—Volumes V. and VI. of the "Explorations for a Railroad Route from the Mississippi River to the Pacific," 1857, half calf, in good condition; a large number of colored and uncolored plates of Mammals, Birds, Fish, etc. etc. On receipt of $7.00 will send to any ordinary point in the U. S., express paid. These volumes are now rare. Address Dr. Shufeldt, Takoma Park, Dist. of Columbia.

A YOUNG woman who has been an assistant for a literary and scientific man desires a similar position. Is an experienced and accurate stenographer and typewriter, thoroughly educated, and sufficiently familiar with literary work to write, independent of dictation. Has some knowledge of the Spanish language. Will go to any part of the United States. Address, Box 147, Ravenna, Ohio